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# Effect of Supplementing Different Levels of *Leucaena diversifolia* Leaf Meal on Milk Yield of Crossbred Dairy Cows

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**Abstract:** A study was carried out at Songa research station of Rwanda Agricultural Research Institute (ISAR) in the Southern Province to evaluate the effect of supplementation with 3 levels of *Leucaena diversifolia* Leaf Meal (LDLM) on milk yield of crossbred dairy cows. Sixteen Jersey x Ankole first and second lactation cows with average body weights of 312 kg and within 30 Day in Milk (DIM) were allocated to four treatments each having four cows in a completely randomized design. As a basal ration, the cows were grazed in paddocks with a mixture of natural grasses mainly *Hyparrhenia rufa*, *Themeda triandra*, *Panicum maximum*, *Brachiaria humidicola* and *Cynodon dactylon* for 8 h day$^{-1}$ and later were offered 4 kg of chopped *Pennisetum purpureum* each in the evening after milking. Treatment diets were 0.0 ($T_1$), 1.48 ($T_2$), 2.21 ($T_3$) and 2.80 ($T_4$) kg of Dry Matter (DM) of LDLM equivalent to 0, 10, 20 and 30% of LDLM, respectively. All cows received equal amounts of the dietary treatments twice a day at 07:00 and 16:00 h. Other components of supplementary rations were rice bran (1.74 kg DM) and minerals which were in form of blocks. Inclusion of LDLM in the rations of dairy cows gave a significant ($p<0.001$) increase in milk yield. Cows on $T_3$ diet gave a significantly ($p<0.001$) higher milk yield (8.44 kg/cow/day) and cows on $T_1$ diet gave the lowest yield (6.01 kg per cow per day). Cows on $T_2$ and $T_4$ diet had similar ($p>0.05$) milk yield of 7.32 and 7.97 kg/cow/day, respectively. In conclusion, it is suggestive that inclusion of 30% LDLM in the ration of lactating crossbred cows was the optimal supplementation level.

**Key words:** *Leucaena diversifolia* leaf meal, supplementation, crossbred dairy cows, milk yield, basal forage

## INTRODUCTION

Poor feeding, particularly during the dry season has been regarded as one of the major limiting factors to high productivity of dairy cattle in various tropical countries. The growth performance of dairy cattle primarily depends on the availability of good quality feeds and feeding regime employed by the farmer. Dairy production in Rwanda is predominantly based on naturally occurring feedstuffs, obtained from the limited land resources available per household and its quality and quantity are greatly influenced by seasonal changes.

Dairy cattle feeding problems becomes critical during the dry season. In this period, the scarce cultivated grass mainly Napier, dry natural pastures and crop residues give inadequate nutrients to support the potential yield levels of these animals. This often calls for supplementation with concentrates to meet the nutrient requirements for maintenance and production of cattle (ARC, 1990). Many smallholder dairy farmers, however in such a nutritionally needy period do not supplement their animals with concentrates, especially oil cakes simply because such commercial concentrates are either too expensive to buy or not readily available. Searching for alternative cheap sources of protein is often advocated to overcome the problem. Some multipurpose trees, such as *Leucaena leucocephala* have been documented as good alternative feed supplement to dairy cattle (Ndemanisho *et al*., 1997). It is in this context that a feeding experiment was conducted at ISAR's Songa research station. The objective of this study was to evaluate the effect of supplementing *Leucaena diversifolia* leaf meal at different levels on the milk yield of dairy cows during the dry season.

## MATERIALS AND METHODS

**Experimental site:** The experiment was conducted at Rwanda Agricultural Research Institute (ISAR), Songa research station located in Huye District in the Southern Province of Rwanda. The station is elevated at 1,650 m a.s.l which is falls under the mid-altitude

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zone of the country. The study was conducted during the dry season specifically July to September when availability of pastures was poor.

**Feed sampling and chemical analyses:** Representative samples of *L. diversifolia*, rice bran, *Pennisetum purpureum*, *Themeda triandra*, *Panicum maximum*, *Hyperrhenia rufa*, *Brachiaria humidicola* and *Cynodon dactylon* were collected at the beginning in the middle and at the end of experimental period. Chemical composition of feed samples such as DM, CP, ADF, NDF, Ash, Ca and P were determined at ISAR-Rubona Laboratory.

**Experimental animals and their treatment:** A total of sixteen $F_1$ crossbred (Jersey x Ankole) lactating cows in their first month of lactation with average body weights of 312 kg and having 1-2 lactations were used in this experiment. Animals were dewormed 2 days before commencement of the experiment using a broad-spectrum anti-helminthic. Animals were randomly allocated into four groups of four cows each and treatments were allocated to the animals in a Completely Randomized Design (CRD). Leaves and soft twigs of *Leucaena diversifolia* were harvested from fodder plots at the station and dried under the shade. Between 08:00 and 16:00 h, the experimental cows were grazed in paddocks with natural grasses comprised of mainly *Themeda triandra*, *Panicum maximum*, *Hyperrhenia rufa*, *Brachiaria humidicola* and *Cynodon dactylon* and in addition each received about 4 kg of chopped *Pennisetum perpureum* after the evening milking. Supplementary diets which were formulated by trial and error method included variable levels of *Leucaena diversifolia* (0.0, 1.48, 2.21, 2.80 kg DM), rice bran (1.74 kg DM) and minerals which were in form of blocks. The supplements were offered at milking in the morning (07:00) and in the evening (16:00) in equal amounts. Cows on $T_1$ (control) received 1 kg of sunflower cake per cow per day as per station's supplementation practice. Animals were provided with water *ad libitum* before and after grazing. Animals were subjected to a preliminary period of 14 days during which the treatment rations were fed at lower rates and increased progressively until the desired ration levels were attained until 56 days.

**Treatments and milk yield recording:** The treatments were 0.0 ($T_1$), 1.48 ($T_2$), 2.21 ($T_3$) and 2.80 ($T_4$) kg DM of LDLM (equivalent to 0, 10, 20 and 30% level of LDLM, respectively). Pre-treatment milk production for each individual cow was recorded for 7 days prior to the actual experimental period. During the experimental period, milk yields were recorded daily and summarized weekly.

## RESULTS AND DISCUSSION

**Chemical composition of the experimental feeds:** The chemical composition of the different grass species that were used in making the basal feed and supplementary diets was is represented (Table 1). The Crude Protein (CP) content of grasses ranged from as high as 8.2% (*Pennisetum purpureum*) to as low as 4.6% (*Themeda triandra*). *Hyperrhenia rufa* had the lowest level (0.23%) while *Pennisetum purpureum* had the highest level (0.42%) of Ca. Crude protein content was highest (26.5%) for supplementary diets in $T_1$ followed by $T_4$, $T_3$ and $T_2$ (Table 1). Except for *Pennisetum purpureum*, the rest of the grasses had a crude protein content below 7% which is the minimum CP required by ruminal microbes (Van Soest, 1994). Such low CP in the pasture was most likely due to the effect of the dry season. The NDF values ranged from 65.3% for *Pennisetum purpureum* to 71.3% for *Themeda triandra* while ADF values ranged from as high as 47.7% for *Themeda triandra* to as low as 40.2% for *Pennisetum purpureum*.

The effect of different levels of *Leucaena diversifolia* on mean milk yield was illustrated (Fig. 1). There was positive response on milk yield on inclusion of *L. diversifolia* Leaf Meal (LDLM) in the rations of dairy cows. Initial mean milk yields for treatments, 1-4 were 5.92, 6.29, 5.97 and 6.31 L/cow/day, respectively. Cows on treatment 2, 3 and 4 achieved a net milk increase of 1.03, 2.47 and 1.66 L/cow/day, respectively.

Cows on $T_2$ and $T_4$ diet had similar ($p>0.05$) average milk yield of 7.32 and 7.97 kg/cow/day, respectively. Cows on $T_3$ diet exhibited a significantly ($p<0.001$) higher milk yield (8.44 kg/cow/day) while cows on $T_1$ diet showed no significant ($p>0.05$) average milk yield (6.01 kg/cow/day) despite the later being superior in terms of CP (Table 1). This could be attributed to ability of *Leucaena* sp., to provide amount of total amino acids digested and absorbed in the small intestine (Mgheni, 1994).

Table 1: Chemical composition of basal pastures and supplementary rations

| | As (DM %) | | | | | | |
|---|---|---|---|---|---|---|---|
| Grass species | DM % | CP | NDF | ADF | Ash | Ca | P |
| *Pennisetum* | 90.8 | 8.2 | 65.3 | 40.2 | 9.4 | 0.42 | 0.33 |
| *purpureum* | - | - | - | - | - | - | - |
| *Hyperrhenia rufa* | 93.2 | 5.4 | 69.4 | 45.6 | 3.6 | 0.23 | 0.15 |
| *Themeda triandra* | 92.1 | 4.6 | 71.3 | 47.7 | 4.1 | 0.26 | 0.11 |
| *Brachiaria humidicola* | 90.5 | 5.5 | 68.8 | 44.8 | 3.8 | 0.40 | 0.22 |
| *Cynodon dactylon* | 91.3 | 5.2 | 70.3 | 45.2 | 4.9 | 0.31 | 0.13 |
| *Panicum maximum* | 93.0 | 5.7 | 69.5 | 46.9 | 4.3 | 0.37 | 0.20 |
| **Supplementary diets** | | | | | | | |
| 1 | 92.6 | 26.5 | 36.8 | 20.1 | - | 0.14 | 0.17 |
| 2 | 93.7 | 17.6 | 51.9 | 32.7 | - | 0.11 | 0.22 |
| 3 | 93.5 | 21.7 | 39.3 | 28.1 | - | 0.22 | 0.32 |
| 4 | 92.8 | 22.4 | 34.4 | 24.9 | - | 0.17 | 0.24 |

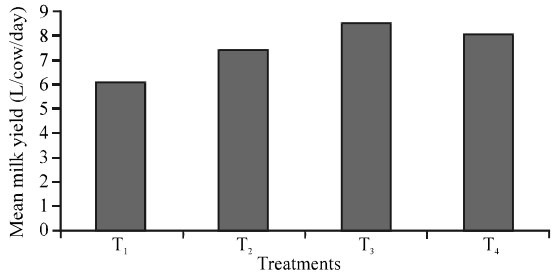


Fig. 1: Effect of experimental diets on mean milk yield

In Tanzania, Shem (1996) reported higher milk yields from crossbred dairy cattle fed basal diet of natural grasses supplemented with 1.2-2.6 kg DM of *Leucaena leucocephala* leaf meal. The differences might be due to level of supplementary diets and breeds of cattle used. In general, there was a rise in milk yield with an increase in inclusion level of LDLM. This might be due to fact that supplementation with the leaf meal produced a favorable bypass protein (undegradable protein in the rumen) (MacDonald *et al*., 1997) which later digested in the lower gut to yield precursors of milk synthesis, thus increasing milk yield (Van Soest, 1994). Based on these findings, 2.21 kg DM of LDLM was the optimal supplementation level.

## CONCLUSION

*Leucaena diversifolia* has been used in Rwanda in agroforesty systems but livestock farmers were using it only during dry season as coping mechanisms of feeds shortage ignoring their importance in dairy farms. The present study has depicted the levels of supplementing LDLM and showed that 20% might be the optimal level which increases milk yields of >8 L/cow/days.

## ACKNOWLEDGEMENT

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## REFERENCES

ARC, 1990. The Nutrient Requirements of Ruminant Livestock. 4th Edn., CAB International, Wallingford, UK., pp: 73-310.

MacDonald, P., R.A. Edwards and G.F.D. Greenhalgh, 1997. Animal Nutrition. 5th Edn., Longman Series, London, Pages: 607.

Mgheni, D.M., 1994. The protein value of cotton seed cake, cereal brans, fish meal, *Leucaena leucocephala* and its botanical fractions. Feed Resour. Network Newslett., 4: 5-12.

Ndemanisho, E.E., L.A. Mtenga and A.E. Kimambo, 1997. The effect of feeding *Leucaena leucocephala* hay as high quality feed supplement for dairy weaner goats. Feed Resour. Network Newslett., 4: 1-10.

Shem, M.N., 1996. Development of supplementary feed diets based on *Leucaena leucocephala* leaf meal for dairy cattle in urban and peri-urban of Shinyanga. Final Report, ICRAF-Shinyanga.

Van Soest, P.J., 1994. Nutritional Ecology of the Ruminant. 2nd Edn., Cornell University Press, Ithaca, New York, USA., Pages: 373.